Ph.D. Synopsis

" Morphotectonics and microseismic activities and its impact on groundwater prospects in Kayadhu river watershed using geospatial techniques, Hingoli district, Maharashtra, India"

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Abstract

The sub-surface tectonic movement plays crucial roles in controlling the development and evaluation of drainage, landforms, structural, groundwater, and etc. Mainly morphotectonic characteristic which is directly related with lithology and terrain's tectonics activities that occur in sub-surface. Groundwater potential in hard rock basaltic area restricted to isolate weathered, fractured zones groundwater movement and interaction between rock-rock. Therefore, groundwater potential zones assessment in Kayadhu watershed, Hingoli district of Maharashtra. The groundwater field observations of well data will be collects from the study area during two consecutive years (Pre and Post monsoons seasons). The groundwater quantitative analysis of the present study area to extract the various characters like terrain analysis (slope DEM, Aspects, geomorphology), morphometric analysis (Drainage, Basin, Bifurcation ratio, Drainage density), geology, structural analysis (Lineaments) and morphotectonic analysis (Geomorphic indices of active tectonic). The research work will carry out under the different stepwise process such as field data collection and interpretation of thematic layers using geospatial techniques AHP techniques for identification of groundwater potential zones in Kayadhu River watershed. The finally suggest the suitable groundwater recharge structures also for augmentation of groundwater table.

Introduction

Groundwater is one of the natural resources that usually connected with human civilization in all ecosystem of the Earth. Groundwater plays major sources of drinking, industries and agriculture purposes. The unmanaged groundwater extraction and inadequate aquifer is main issue in the groundwater depletion in different parts of the world.

Groundwater is crucial for life in the arid and semi-arid regions because it is only the primary source for drinking as well as irrigation. Groundwater can occurs in pores (connected voids) in the rocks, fractures, joints/cracks and weathered rock aquifuge. As in the study area the weathered and fractures basalt is primary aquifer for groundwater storage.

Many researchers have been reported that appropriate groundwater management plans within watershed require information extract from satellite data and field survey. The extract data process under morphometric and morphotectonic analysis. Neo-tectonic or active tectonic activity can be manifested in the drainage basin morphology and in the landform evolution and development (Horton, 1932; Radhakrishna, 1992; Sinha Roy 2001; Pati et al., 2008; Singh and Srivastava, 2011). Geospatial techniques to study and assess the

morphological aspects such as extraction and analysis specifically geological structures, lineaments and drainages pattern which allow us to validate the control of tectonic activity over Kayadhu watershed zone (s).

Geospatial technologies are the tools for analysis and assessment of the groundwater storage and movements and its relation to the drainage network, lineaments, geology, geomorphology, slope, rainfall, etc. to identify and delineates the groundwater recharge potential zones and to recommends suitable recharge sites (Sahu et al., 2022). The groundwater quality and quantity is threatened by natural and anthropogenic inputs include climate change, scarcity and excessive use of groundwater. Furthermore, the changing climatic condition may pose serious threat on its availability and accessibility to the society from local to global scale.

In the Kayadhu watershed zones, the groundwater is used to cater the needs of drinking water through rural water supply, private domestic wells and harnessed for agricultural. The groundwater condition in the region is worsening rapidly to hydrological stress from climatic and human-induced activities consequently the groundwater level is declining. The sustainable groundwater development and management is essential.

Geospatial and analytic hierarchy process (AHP) techniques

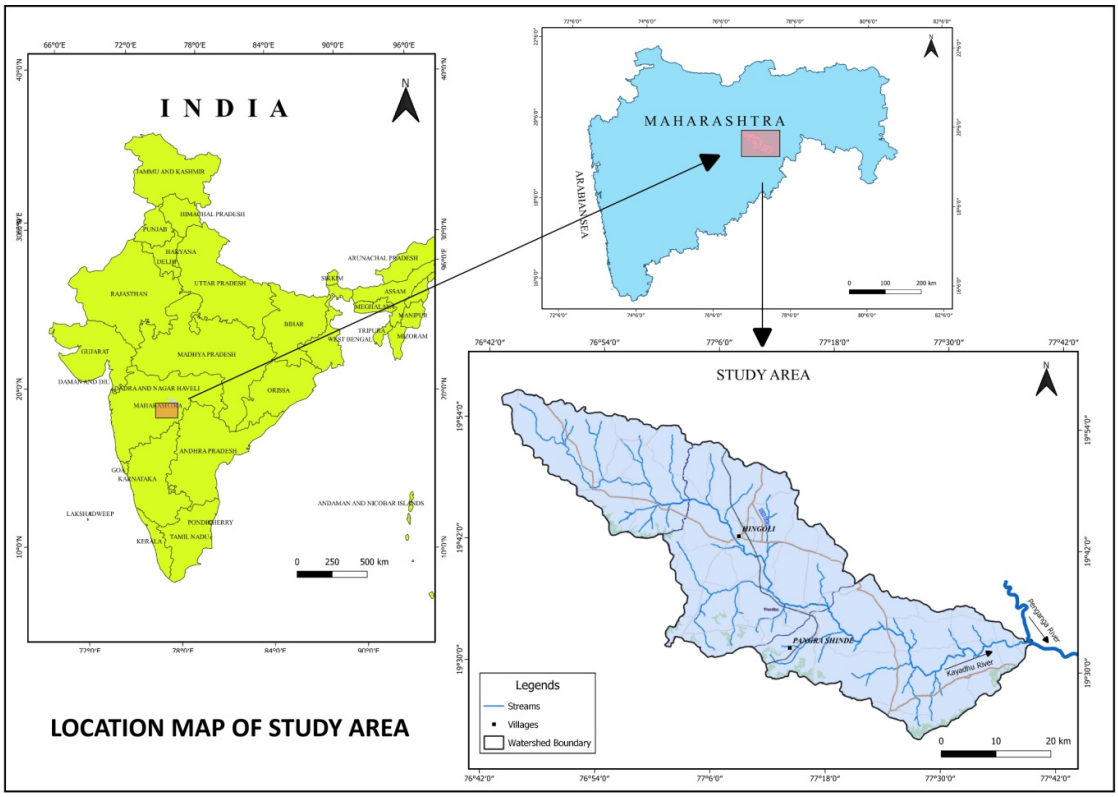
Geospatial data is the data about object, events, or phenomena that have a location on the earth. The location may be static in the short-term, like the location of a river an earthquake events, road, malnutrition among children, or dynamic like a moving vehicle or pedestrian, the spread of an infectious disease. Geospatial data combine location and attribute information and often also temporal information or the time at which the location and attributes exist. Geospatial data usually involve information of public interest such as road, localities, rail lines, water body, and public amenities.

AHP technique was introduced by Thomas L.Saaty in 1970s. It is a simple and powerful which aid in taking logical decision in various field application such as natural hazard mapping and management, environmental impact assessment, groundwater potential, flood risk etc. It is also known as multi-criteria decision making tool. Integrated use of AHP with GIS tools/software can be utilized in the structured and transparent way for analysis of spatial data (Feizizadeh and Blaschke2013; Suarez-vega et al., 2011).AHP are effective tools

frequently applied along with GIS and RS for qualitative and quantitative analysis in water recourses management (Sahu et al.,2022)

Proposed study area

The Kayadhu watershed covers ~ 813.17 km^2southern part of the Hingoli district, Marathwada region of the Maharashtra state and bounded with 76°86′to 77°24′ E and 19°40′ to 19° 71′N covered under Survey of India (SOI) toposheets of numbers 56E/2, 56E/3, 56E/4, 56A/11, 56A/12, 56A/14, 56A/16 on the scale of 1:50000. Godavari River located in the eastern region of Maharashtra state. The others major tributaries of Godavari River are the Purna, the Asna, the Manjra and the Penganga. The drainage pattern are dendritic to sub-dendritic with high drainage density. Geologically study area comprised with simples lava flows of South East Deccan Volcanic Provinces (SEDVP). Physiography, it is exhibits the Ajanta hill range with Hingoli plateaus of mountains area, regional slope towards the south-east having an elevation ranges from 561m to 304m (amsl). The climatic condition is dry except during southwest monsoon, annual rainfall is around 750 to 900mm.



Location map of the Kayadhu Watershed.

Objectives

1. Preparation of the various thematic maps of the study area such as drainage density, lineament, geology, geomorphology etc. using geospatial techniques.
2. To identify spatially distribution of tectonic and seismic zones in the watershed.
3. To assess the groundwater potential by integrate with thematic data-sets and suggest the suitable recharge structures in the study area.
4. To make an attempt to demarcate 'zone of deformation' which in turn help the cause of sustainable development of houses (seismic proof) in such microseismically active area.
5. To suggest remedial measures to enhance groundwater potential in the study area.

Methodology

Preparation of vector base thematic maps such as drainage, lithology, geomorphology, structural, using survey of India (SoI) toposheets and GIS quadrangle maps 1:2,50,000 scale (56A and 56E) along with satellite imagery with aid of geospatial tools and techniques. Extraction of terrain features like DEM, slope/ relief from ASTER GDEM (30 m) raster data is computed by GIS spatial analyst extension tools. Incorporation of field observation data, lithology, structural information, and geomorphology, hydrogeology, base overlays etc. To classify high, moderate and low groundwater potential zones and proper recharge structures for enhance groundwater table within the study area.

Importance of the study

International status

Groundwater plays a key role in meeting the water needs of various user sectors in the all country. First international conference on groundwater quality research, at rice University in October 1981.several studies provide an overview of the chemicals and microbial contamination (John et al., 1985). Roughly 60% of global groundwater use is for irrigation most of the rest is used in household and industry. Groundwater uses vary significantly by country, and partly depend on climate. Globally, over 2 billion people use groundwater as source of drinking water. In some countries such as Pakistan, Saudi Arabia, and Syria, irrigation accounts for 90% of groundwater use (National ground water association).

National status

Groundwater has become a more important and reliable source of fresh water for potable and agricultural uses in India. In recent years, public reliance on groundwater in India for drinking and irrigation uses has been amplified due to deterioration in quality and in adequate quantity of surface water recourse. In India the net groundwater availability is 399 billion cubic meter. The annual groundwater draft is 231 billion cubic meters (bcm); 213bcm is used for irrigation and 18bcm is utilized for domestic and industrial use (CGWB 2006). In India, it estimated that per capita water availability was 2309meter cubic. In year 1991 and it was depleted to 1902 meter cubic in year 2001.it is projected to reduces in year 2025 and 2050 by 1401 meter cubic and 1191meter cubic, respectively. The SERT (2009) reported that most part most part of India will face a severe water scarcity by 2050.

Significance of the proposed study

By assessing groundwater potential zones in the study area will help to identification future threats to groundwater level and this will help to frame the groundwater policy makers to prepare groundwater conception policy according to study results.

Work plan

1. Literature survey of proposed work
2. Geological mapping and Morphometric analysis of study area using GIS tools and techniques.
3. Based on geological, hydro geological and geomorphologic factors establishment sampling sites and collection of Pre-monsoon and Post-monsoon groundwater.
4. Preparation of thematic maps by using GIS software in the study area.
5. Delineation of groundwater potential zones in the study area for identifying suitable recharge structures using geospatial tools and AHP techniques and generate groundwater potential map of the study area.

Timeline of the research work

Time (in Month)	Tasks
00-06	Review of literature
01-24	Field work / data collection
24-36	Data interpretation. Writing of thesis, publication writing.

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